Audio Capture & Playback Adapter

Installation and Technical Reference Manual

34F2795

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34F2795
Tecmar #940955 Rev. C

Copyright Protection Notice

Prerecorded audio material is normally protected by the copyright laws of the United States and other nations. The users of the audio digitizing capabilities of the Audio Capture & Playback Adapter are advised that the digitizing of audio material from sources for which they do not own the copyright may be subject to the United States Copyright law, Public Law 92-553 and other laws. The user of the Audio Capture & Playback Adapter is liable for any infringement of the law.

FCC Required Instructions

This equipment generates and uses radio frequency energy and if not installed and used properly, i.e., in strict accordance with the operating instructions, reference manuals, and the service manual, may cause interference to radio or television reception. It has been tested and found to comply with the limits of a Class B computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a residential installation.

If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient the receiving antenna
- Relocate the equipment with respect to the receiver.
- Move the equipment away from the receiver.
- Plug the equipment into a different outlet so that equipment and receiver are on different branch circuits.

If necessary, the user should consult the dealer or an experienced radio/television technician for additional suggestions. The user may find the following booklet prepared by the Federal Communications Commission helpful:

"How to Identify and Resolve Radio-TV Interference Problems."

This booklet is available from the U.S. Government Printing Office, Washington, DC 20402, Stock No. 004-000-00345-4.

The manufacturer is not responsible for an radio or TV interference caused by unauthorized modifications to this equipment. It is the responsibility of the user to correct such interference.

You must use a shielded cable with any device connected to this product.

Canadian Department of Communications Compliance Statement

This equipment does not exceed Class B limits per radio noise emissions for digital apparatus, set out in the Radio Interference Regulation of the Canadian Department of Communications. Operation in a residential area may cause unacceptable interference to radio and TV reception requiring the owner or operator to take whatever steps are necessary to correct the interference.

Avis de conformité aux normes du ministre des Communications du Canada

Cet équipement ne dépasse pas les limites de Class B d'émission de bruits radioélectriques pour les appareils numériques, telles que prescrites par le Réglement sur le brouillage radioélectrique établi par le ministre des Communications du Canada. L'exploitation faite en milieu résidentiel peut entraîner le brouillage des réceptions radio et télé, ce qui obligerait le propriétaire ou l'opérateur à prendre les dispositions nécessaires pour en éliminer les causes.

Japan VCCI

This equipment is Class 1 Equipment (information equipment to be used in commercial and industrial districts) which is in conformance with the standard set by Voluntary Control for Interference by Data Processing Equipment and Electronic Office Machines (VCCI) with an aim to prevent radio interference in commercial and industrial districts.

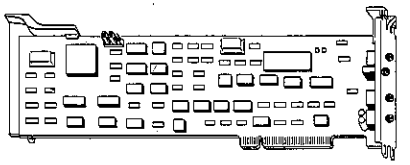
This equipment could cause interference to radio and television receivers when used in and around residential districts.

Please handle the equipment properly according to the instruction manual.

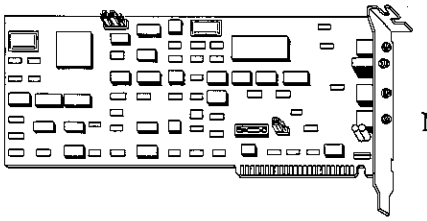
Checklist

In addition to this manual, your carton should contain the following items. You should check to make sure they are all present before you install your Audio Capture & Playback Adapter.

° Audio Capture & Playback Adapter board

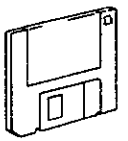


Micro Channel Version



Non-Micro Channel Version

° Audio Adapter Software Diskette



If either of these items are missing or damaged, or if you encounter problems while using this product, refer to your point of sale contact.

Contents

Section 2: Technical Reference

Introduction

Tecmar's stereo Audio Capture & Playback Adapter is a high quality audio board that receives input from a microphone or standard line, digitizes the signal, and stores it in the computer. The adapter can play back the digitized signal continuously to a speaker, headphone or standard audio line. One version of the Audio Capture & Playback Adapter (/A) is designed for IBM® Micro Channel® PS/2® computers. The other version of the Audio Capture & Playback Adapter is designed for IBM non-Micro Channel PS/2 computers.

Features

- Uses the Texas Instruments TMS320C25 digital signal processor
- 8K x 16 static RAM on-board memory
- Audio Capture & Playback Adapter/A is compatible with IBM Micro Channel PS/2 computers, while the other version is compatible with non-Micro Channel PS/2 computers
- Two independent input channels
- Stereo input sampling (line left and line right) at 44.1 KHz at 16 bits
- Monaural sampling (line right or microphone) at 88.2 KHz at 16 bits
- Microphone or line input is software selectable
- Microphone gain is software selectable

- Two independent output channels can each drive a line in conjunction with speakers or headphone
- Software selectable option allows you to use the internal speaker on IBM PS/2 Micro Channel computers (Audio Adapter/A only)
- Audio frequency response is 12 Hz to 24 KHz nominal on the output and 12 Hz to 20 KHz nominal on the input
- Power on calibration assures audio quality
- Menu-driven diagnostics let you test the functionality of the board
- Four Audio Capture & Playback Adapter boards can be installed in one system
- ID #6E6C assigned by IBM (/A Audio Adapter only)
- Non-Micro Channel Adapter fits in short slot of the Model 25
- Twelve month warranty will be provided by IBM
- Audio Capture & Playback Adapter/A is UL approved in the IBM PS/2 Model 50 (IBM #8550), Model 60 (IBM #8560), Model 70 (IBM #8570) and Model 80 (IBM #8580)
- Non-micro channel Audio Capture & Playback Adapter is UL approved in the IBM PS/2 Model 30 (IBM #8530)

System Requirements

- You must have one free slot in your computer to install the Audio Capture & Playback Adapter

- We also recommend that you have:
  A hard disk drive
  At least 640 KB system memory
- DOS version 3.3 or higher to run the diagnostics

Input and Output Devices

You can use any of these devices with the Audio Capture & Playback Adapter. These options must be purchased separately and they should meet the following specifications.

- Microphone for input:
  Required:
  3.5 mm mini jack connector
  Recommended specifications:
  Cardioid pickup pattern
  600 ohms maximum impedance
  Cable length under 6 feet
  Open circuit voltage sensitivity level between
  -60 (more sensitive) and -80 db (less sensitive)
  Note: Microphone sensitivity is based on 0db = 1 volt per micro bar. More sensitive microphones allow table top use. Less sensitive microphones generally require hand-held operation. Details on the sensitivity level can generally be found on the microphone's spec sheet.
  Frequency response (frequency curve) depends on desired quality and application. Guidelines:
  Music applications: 20 Hz to 20 KHz 3.5 db
  Speech applications: 50 Hz to 12 KHz 5 db
- Speakers:
  4-8 ohms
  Shielded cables with 3.5 mm stereo mini jack connectors to plug into the Audio Adapter and connectors on the other end to match your speakers

- Headphones:
  8 ohm minimum
  3.5 mm stero mini jack

- Line input/output cables:
  Shielded cables with 3.5 mm stereo mini jack connectors to plug into the Audio Adapter with connectors on the other end to match your other audio equipment (typically this will be male RCA jacks)

Warning: Prolonged exposure to excessive noise can cause hearing loss. The volume level on audio headphones must be kept at a reasonable level to avoid hearing loss.

Caution: Please exercise care when hooking up adapter hardware to your Audio Capture & Playback Adapter. Careless handling could result in damage to the connectors on the board.

Ordering Information

Both versions of the Audio Capture & Playback Adapter come with software and manual.

Item	IBM Part Number
Audio Adapter for non-Micro Channel computers with software and manual	34F2783
Audio Adapter for Micro Channel computers with software and manual	34F2784

Section 1

Installation and Testing

Contents

Chapter 1

Installing the Micro Channel Adapter

Copying an Option Diskette

Before you install your Audio Capture & Playback Adapter (referred to as the Audio Adapter in this manual) in your PS/2 Micro Channel computer, you must run the *Copy an option diskette* program from your PS/2 Reference Diskette. This program will update your IBM Automatic Configuration Program. You should use a backup copy of your Reference Diskette to preserve the original without any changes to it.

You will need these items to copy an option diskette:

IBM PS/2 Reference Diskette (backup copy)

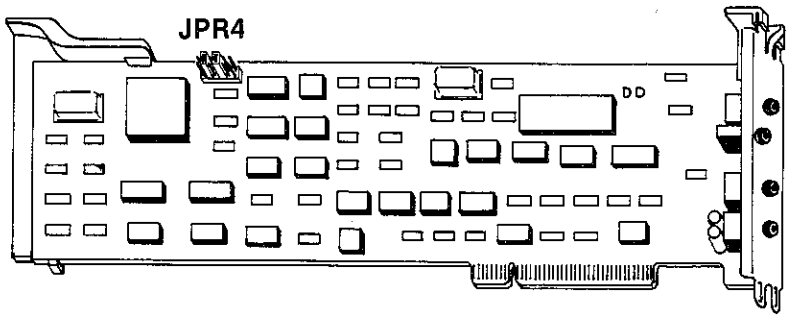
Audio Adapter Software diskette

- Insert your IBM Reference Diskette and turn on your computer (or reset it by pressing Ctrl/Alt/Del, if it is already on).
- Select **5. Copy an option diskette** from the Main Menu.
- Insert your Audio Adapter Software Diskette when you see the instruction, *Insert your New Option Diskette in drive A: Press Enter to continue.*
- Insert your IBM Reference Diskette (backup copy) when told to do so.

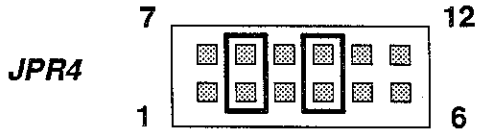
When you see the message, *Update of Product 2 Diskette Complete*, you are ready to install your Audio Adapter in your computer.

Installing the Board

- Unpack your Audio Adapter and place it component side up on a clean, static-free surface.



- Locate the jumper block labeled JPR4 on the board. It is reserved for future expansion of the Audio Adapter. Do not change the position of the two terminators on JPR4. They must remain as shown in the drawing below.



- Turn off the power to your computer.
- Turn off the power to all of your external options (monitor, printer, etc.).
- Unplug your computer and all other options from their source of power (wall outlets, power strips, etc.). Disconnect all external cables.
- Remove your computer cover by following the directions under Removing the System Unit Cover in the **Quick Reference** manual that came with your PS/2 computer.
- Choose an expansion slot for your Audio Adapter.
- Install the Audio Adapter in your computer by following the instructions under *Installing an Adapter* in the **Quick Reference** manual that came with your PS/2 computer.
- Replace your computer cover by following the directions under *Installing the System Unit Cover* in the **Quick Reference** manual that came with your PS/2 computer.
- Re-connect all power and external cables to your system.

Running Automatic Configuration

After you install the Audio Adapter in your computer, you are ready to run the automatic configuration program. The automatic configuration program allows your computer to recognize the presence of your Audio Adapter.

- Insert your Reference Diskette and turn on your computer.

An Adapter Configuration error message #165 will appear indicating that you should run automatic configuration, if you have added or removed an adapter.

- Follow the instructions that appear on the screen. Respond **Yes** when asked if you want to automatically configure the system"

When you see a message indicating that the automatic configuration is complete, press Enter. The computer will reboot with your new configuration installed.

If you reboot without first removing the Reference Diskette, you can select **1. View Configuration** from the Set Configuration menu to see the new configuration. The information for the Audio Adapter will show the slot number, address and interrupt.

If the setting for the Address or Interrupt number conflicts with some other device in your system, an asterisk will appear next to that item. To choose an alternate setting, you should select **2. Change Configuration** from the Set Configuration menu. Follow the instructions on the screen to select an alternate setting and then press **F10 Save** to install the new setting(s) or Escape to cancel.

- After you run Automatic Configuration, you should run the Audio Adapter diagnostics, according to the instructions in Chapter 4. The basic diagnostics should not be run with input or output devices attached to the Audio Adapter.

Chapter 2

Installing the Non-Micro Channel Adapter

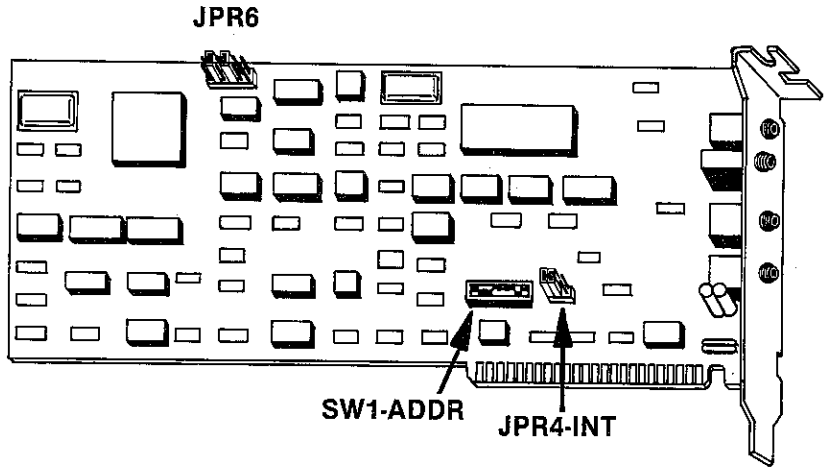
The Non-Micro Channel Board

This chapter shows the non- Micro Channel version of the Audio Capture & Playback Adapter (referred to as the Audio Adapter in this manual) as it comes shipped from the factory and provides setup instructions for the switches and jumpers on the board.

The **Guide to Operations** that came with your IBM PS/2 has instructions and illustrations that you can refer to while you are installing your Audio Adapter. You should have this manual handy for reference.

If you are not familiar with setting switches and jumpers, or if it has been some time since you have done so, please read Appendix B. The black dots on the diagrams of switch settings in this manual represent the ON and OFF positions.

- Unpack the Audio Adapter and place it on a clean, static-free surface.



Factory Settings

The Audio Adapter comes from the factory with these settings:

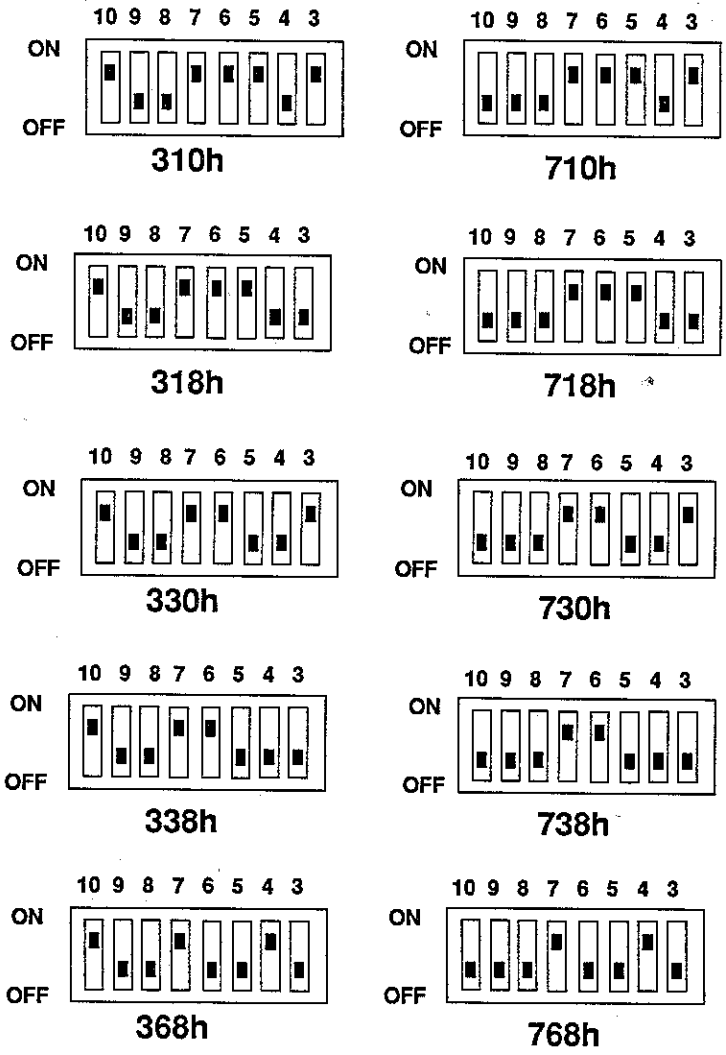
° The base Input/Output address is 310 hexadecimal

° The Interrupt Request Line is IRQ3

Input/Output Addresses

The switch module labeled SW1-ADDR selects the base address for the Audio Adapter. The default setting is 310 hexadecimal. If the default setting conflicts with another device in your system, you can easily change it by copying one of the alternate settings in the diagrams on the next page.

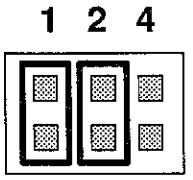
- Double check your settings to be sure that they match the diagram precisely.



Interrupts

The jumper labeled JPR4 selects the Interrupt Request Line. The default setting is IRQ 3.

JPR4 with IRQ3 Selected



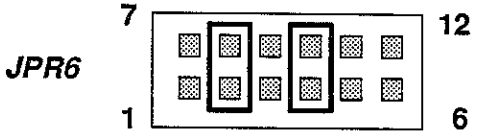
Six Interrupt Request Lines, numbered 2 through 7, are available to accomodate a wide variety of system configurations and options. If you have a conflict with another device in your system, you can change the Interrupt Request Line.

Follow these instructions to change the Interrupt Request Line:

- Locate the jumper labeled JPR4. Each column of pins represents a value (1, 2 and 4 respectively).
- Place the jumper over one or more pairs of pins so that the total value of the column numbers equals the interrupt you want to use. For example, when the columns labeled 1 and 2 are jumpered, then interrupt 3 is selected. When only the column labeled 2 is jumpered, interrupt 2 is selected. When all three columns are jumpered, interrupt 7 is selected (1 plus 2 plus 4).

JPR6

- Locate jumper block JPR6 on the board. It is reserved for future expansion of the Audio Adapter. Do not change the position of the two jumpers on JPR6. They must remain in position as shown.



Installing the Board

- TURN OFF THE POWER TO YOUR PERSONAL SYSTEM/2 COMPUTER and unplug it from its source of power. It is important that no power is applied to the unit while switches are being set or while the board is being installed. Failure to do so may result in serious damage to the computer.

- Remove the cover of your computer according to the instructions in your IBM **Guide to Operations**.

If you have a Model 25, you may need to unplug the cable from the connector labeled J4 as you swing the bottom cover out and down. This will protect the pins on the cable and allow the cover to open completely.

- Choose the slot where you will install your Audio Adapter.

  If you have an IBM Personal System/2 Model 25, you can use the short (top) slot.

- Remove the slot cover from the slot you have selected. Use a screwdriver to remove the screw that holds the slot cover in place. Set the slot cover and screw aside. You will need the screw later, but you will not replace the slot cover.

- If you have a Model 30, remove the plastic insert, located at the rear of the computer, from the slot where you are installing the Audio Adapter. Refer to the drawing in your IBM **Guide to Operations.**

- Hold the Audio Adapter by the top corners and slide it into its slot. Make sure that the board is plugged firmly into the connector in the expansion slot.

- Replace the screw you removed earlier to secure the board in its slot.

- Replace the cover of your computer according to the instructions in your **IBM Guide to Operations.**

- Reconnect any cables or power cords you removed earlier.

- Turn on your computer and make sure that it is working properly. If there is any problem, check the cables and plugs to make sure that they are secure.

- Run the Audio Adapter diagnostics, according to the instructions in Chapter 4. You should do this before connecting any input or output devices to the board.

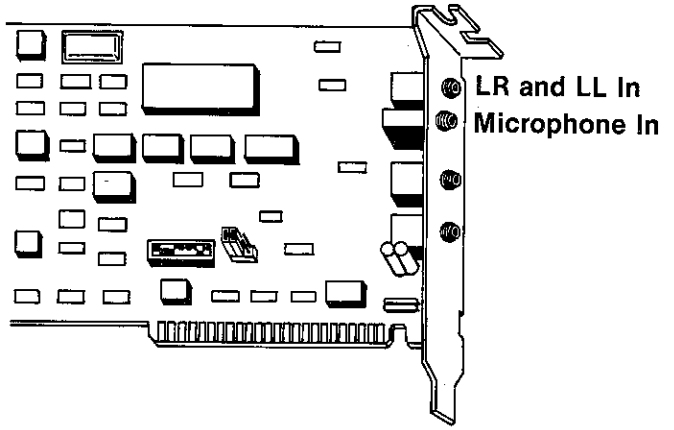
Chapter 3

Connecting Input and Output Devices

Connecting Input Devices

Before connecting any input devices to the Audio Adapter, you should run the basic diagnostics, according to the instructions in Chapter 4.

You can connect a microphone and/or a line level signal to the Audio Adapter.



Connecting a Microphone

You can plug a microphone into the second connector (microphone in) from the top of the Audio Adapter's retaining bracket. The microphone input uses a mini-phone jack (3.5mm). The microphone wire should be as short as possible (typically less than six feet) to avoid noise pickup.

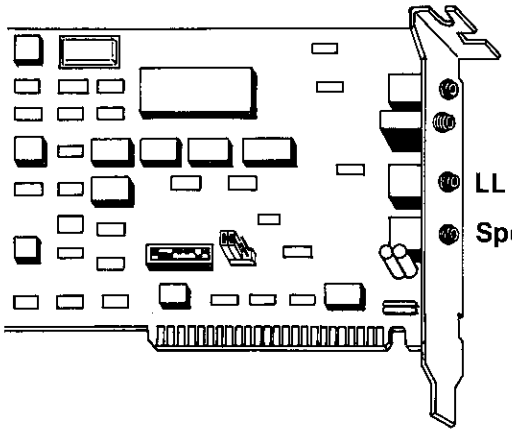
Connecting Line In to Other Equipment

You can plug a line level stereo signal into the first connector (LR and LL In) at the top of the Audio Adapter's retaining bracket. The line input connector is a 3.5 mm mini stereo jack. The line level input will receive normal levels from other audio equipment outputs - typically called "line out".

Connecting Output Devices

Before connecting any output devices to the Audio Adapter, you should run the basic diagnostics, according to the instructions in Chapter 4.

You can connect headphones, speakers and audio equipment to the Audio Adapter.



Connecting a Speaker/Headphone

You can plug a speaker or headphone set into the bottom connector (Speaker/Headphone out) of the Audio Adapter's retaining bracket. The speaker/headphone connector is a mini-stereo phone jack (3.5mm). The output is capable of driving load greater than or equal to 4 ohms per channel.

Connecting Line Out to Other Equipment

You can plug the third connector (LL and LR Out) from the top of the Audio Adapter's retaining bracket to other equipment Line In. The line output connector is a 3.5 mm mini stereo jack The line level output will drive normal levels into inputs of other audio equipment - typically called "line in".

Chapter 4

Testing the Audio Adapter

Audio Adapter Software Diskette

The Audio Adapter software diskette has these files on the root (main) directory:

"**@6E6C.ADF**" is the adapter description file that defines the hardware on the Micro Channel Audio Adapter. If you have the non-Micro Channel Audio Adapter, you will not use this file.

README is a text file that has general information about the Audio Adapter.

The Audio Adapter Software diskette also has these three directories:

"\DIAG" is a directory that contains diagnostic software for testing the Audio Adapter. The diagnostic program, ACPADIAG.EXE, is in this directory. ACPADIAG.EXE is described in this chapter.

"\DEMO" is a directory that contains executable programs that demonstrate the capabilities of the Audio Adapter.

"\SAMPLES" is a directory that contains programming examples.

\DIAG, \DEMO and \SAMPLES all contain a "README" text file which provides information on the files within that directory. To display the contents of any of the README files, use the DOS "cd" command to change to the appropriate directory (cd\, cd \diag, cd \demo or cd \samples) and enter this DOS command:

```
>type README
```

Using the Diagnostics

After you install the Audio Adapter in your computer, you are ready to test your board by running the Audio Adapter's diagnostics.

- You should copy the file ACPADIAG.EXE from your Audio Adapter diskette to a backup floppy diskette or to your hard disk. (If you like, you can create a subdirectory for ACPADIAG.EXE on your hard disk.) Place the original Audio Adapter diskette in a safe place for storage.

This example will copy the file ACPADIAG.EXE from the \DIAG subdirectory on the Audio Adapter diskette in floppy drive A: to a subdirectory called \ACPA on drive C:

```
>COPY a:\diag\acpadiag.exe  c:\acpa
```

- To run the basic diagnostics, enter this command from the drive where you have the file ACPADIAG.EXE:

```
>ACPADIAG
```

The basic tests will be performed automatically on each Audio Adapter installed in the system. Messages will appear telling you whether the board(s) have passed or failed. If any errors occur, you might want to run the Audio Adapter's advanced diagnostics.

The menu-driven advanced diagnostics help you to pinpoint problems, test cabling, and become familiar with the Audio Adapter's input and output connectors.

- To run the advanced menu-driven diagnostics, enter this command from the drive where you have the file ACPADIAG.EXE:

```
>ACPADIAG /A
```


The Diagnostics menu will appear. The sample screen below illustrates what you might see after selecting a variety of options from the menus. This example shows a Micro Channel system with four Audio Adapters installed.

```
Select  Test  Tone  Loop  Toggle  Exit  Help

                ACPA DIAGNOSTICS  Version 1.0

          Use Arrow Keys to select item; then press Enter

┌──────────────────────────────────┐ ┌──────────────────────────────────┐
│Card #1 Addr FDC0h Int 3  Slot 1  │ │Card #2 Addr FDC8h Int 4 Slot 2   │
│Mike Gain: low     Speaker: off   │ │Mike Gain: low     Speaker: on    │
│Interrupts              passed    │ │Oscillator:                       │
│Sample Memory           passed    │ │  Ch. Right: 2.7 Khz   7.8 dbv    │
│Shared Memory           passed    │ │  Ch. Left:  2.7 Khz   7.8 dbv    │
│Arbitration             passed    │ │                                  │
│Analog Loop             passed    │ │                                  │
└──────────────────────────────────┘ └──────────────────────────────────┘
┌──────────────────────────────────┐ ┌──────────────────────────────────┐
│Card #3 Addr FDD0h  Int 5  Slot 3 │ │Card #4 Addr FDD8h Int 6 Slot 4   │
│Mike Gain: low     Speaker: on    │ │Mike Gain: hi      Speaker: off   │
│Digital Loop                      │ │Digital Loop                      │
│  Ch. Left in to Ch. Left out     │ │  Ch. Right in to Ch. Right out   │
│  Microphone in to Ch. Right out  │ │  Ch. Right in to Ch. Left out    │
│  Sampling Rate: 44.1 Khz         │ │  Sampling Rate : 88.2 Khz        │
│                                  │ │                                  │
└──────────────────────────────────┘ └──────────────────────────────────┘

Esc = Cancel    F1 = Help    F3 = Exit
```

The Audio Adapter Diagnostics screen has these general areas:

Action Bar

```
Select  Test  Tone  Loop  Toggle  Exit  Help
```

The Action Bar across the top of the screen lets you display the Test Software pull-down menus.

- Use the right and left arrow keys to choose the menu you want and then use the up and down arrow keys to move through the choices on the menu. Press Enter to select the highlighted item.

Message Area

Instructions and helpful information will appear in the area below the Action Bar.

Card Status Windows

```
Card #1 Addr FDC0h Int 3  Slot 1
Mike Gain: low        Speaker: off
Interrupts              passed
Sample Memory           passed
Shared Memory           passed
Arbitration             passed
Analog Loop             passed
```

The four card status windows accomodate the maximum number of Audio Adapters (cards) allowed in one system. Each window has hardware setup information, status messages, and instructions (when appropriate). The sample screen on page 4-5 shows a system with four boards installed.

Function Key Bar

The Function Key Bar at the bottom of the screen lists actions you can perform by pressing special keys.

The Test Menus

```
Select  Test  Tone  Loop  Toggle  Exit  Help
```

- You can select items from the pull-down menus by using the arrow keys and then pressing Enter. As a shortcut, you can bypass the pull-down menus by holding down the Alt key and pressing the key specified for that item.

Select Menu

Card # 1	Alt + 1
Card # 2	Alt + 2
Card # 3	Alt + 3
Card # 4	Alt + 4

The **Select** menu lets you choose the active Audio Adapter. A double line appears around the active card.

Test Menu

Active Card - basic tests one pass	Alt + B
Active Card - loop/test continuous	Alt + C
Active Card - loop/test stop on error	Alt + E
All cards - continuous and log	Alt + L

The **Test** menu runs several routines to test the digital section and analog input and output sections of the Audio Adapter's hardware. This verifies correct operation of the board. The routines include the Interrupt Test, Sample Memory Test, Shared Memory Test, Arbitration Test and Analog Loop Test.

An error message appears if a problem is detected.

- Contact your service representative, if you receive any error messages.

If you select **Active Card - basic tests one pass,** the routines will be performed once each on the active card (board).

If you select **Active Card - loop/test continuous,** each card test is repeated indefinitely on the active card until you press the Enter key. When you press Enter, the next test is repeated indefinitely until you press the Enter key again. This cycle is repeated until all the Card tests have been performed. The number of passes and number of errors will be displayed for the current test. You can cancel these tests at any time by pressing Escape. The current test in progress will complete before the Escape is recognized.

Active Card - loop/test stop on error works like *Active Card - loop/test continuous,* except that the cycle of testing stops if an error occurs.

If you select **All Cards - continuous & log,** each Card Test routine is performed on every Audio Adapter in the system (one board at a time). The cycle of tests is

repeated continuously on each board (if there is more than one) until you press Escape. Results are saved in a text file called ACPADIAG.LOG. If you have only one Audio Adapter in the system, but you want all the Card Tests to be performed repeatedly, you must select *All Cards - continuous & log.*

The Message Area will indicate if any errors have occurred. Any existing ACPADIAG.LOG file will be erased when you run the diagnostics and first select *All Cards - continuous and log.* If you select *All Cards - Continuous and log* again before exiting the diagnostics, results will be added to the existing ACPADIAG.LOG file. If you wish to save an existing ACPADIAG.LOG file, you should rename it before you run the Audio Adapter diagnostics.

Tone Menu

Oscillator Start	Alt + O
Change Oscillator Values	Alt + V

The **Tone** utility verifies the output circuitry of the Audio Adapter. You can use this utility program to check whether your output devices are connected properly. The Tone utility also gives you a way to become familiar with the Audio Adapter's output connectors.

Follow the instructions in Chapter 3 to connect output devices before you run the Tone utility. If you have a non-Micro Channel computer, you must have some output device connected in order to hear the tones. If you have a Micro Channel computer, you could use the internal speaker for this program to monitor the right channel output.

During **Oscillator Start** tones are generated to the right and left output channels, using a digital oscillator program. You can stop the tone by pressing Escape or choosing another test from the Test Menu, while that board is active.

The default power up settings are 440 Hz at -20 dbv for both the right and left channels. During the Tone utility, you can press F7 to lower the volume, F8 to increase the volume, F5 to decrease the frequency and F6 to increase the frequency. Volume is lowered or raised in 1 dbv steps, while frequency is decreased or increased on a chromatic scale.

Change Oscillator Values allows you to enter various values for right and left channel frequency and right and left channel amplitude of the digital oscillator. Use the Tab key to change fields; enter the value you want; then press Enter to accept all current values. You can also use the F5, F6, F7, and F8 keys (explained above) to adjust the volume and frequency.

The Oscillator Frequency and Volume must be set to audible levels. The frequency should be between 500 Hz and 5000 Hz. The volume should be between +7.8 dbv (maximum volume) and -50.0 dbv (very quiet).

Loop Menu

L in to L out, R in to R out	Alt + W
L in to L out, Mike to R out	Alt + X
R in to R and L out	Alt + Y
Mike in to R and L out	Alt + Z

The **Loop** utility program verifies the analog input circuitry, the ADC converter, the internal interrupt logic, loading and unloading of Sample Memory blocks, DAC output, and the analog output circuitry. You can use this program to check whether your input and output devices are connected properly. The Loop selection also gives you a way to become familiar with the Audio Adapter's input and output connectors and the various modes possible.

Follow the instructions in Chapter 3 to connect input and output devices before you run the Loop utility. If you have a non-Micro Channel computer, you must have some output device connected. If you have a Micro Channel computer, you could use the internal speaker for output.

L in to L out, R in to R out tests Line Left and Line Right at 44.1 KHz sampling rate.

L in to L out, Mike to R out tests Line Left and microphone at 44.1 KHz sampling rate.

R in to L and R out tests Line Right at 88.2 KHz sampling rate.

Mike in to L and R out tests the Microphone at 88.2 KHz sampling rate.

Note: For selections at 44.1 KHz (stereo inputs), the output is also stereo. For inputs at 88.2 KHz, the outputs are monaural and routed to the right and left DAC output. Also, since the outputs are always at 88.2 KHz playback rate, data sampled at 44.1 KHz is converted to 88.2 KHz via an interpolation filter in the diagnostic code.

During the Loop utilities, you can adjust the volume level by pressing F7 (softer) or F8 (louder).

Toggle Menu

Mike Gain	Alt + M
Speaker	Alt + S

Toggle operates like an on/off switch for the Microphone Gain and PS/2 internal speaker.

Mike Gain controls the sound sensitivity level of the Microphone. High Gain, the more sound sensitive mode, picks up softer sounds, but may include background noise. Low Gain requires louder input, but includes less background noise.

Speaker switches the active board's right channel output on and off the audio line to the Micro Channel computer's internal speaker. This item operates only for the Micro Channel Audio Adapter.

Exit Menu

Exit Diagnostics	F3
ESC = Resume	

The **Exit** menu has these selections:

Exit Diagnostics leaves the diagnostic software and returns to the operating system.

ESC = Resume returns to the Action Bar.

Help Menu

Help on Help	Alt + H
Keys Help	Alt + K

Help on Help tells you how to get help messages. You can obtain help on any of the Action Bar or pull-down selections by highlighting the selection and then pressing the F1 key.

Keys Help provides quick explanations of what the function keys do.

Note: The Tone and Loop utilities can be performed on more than one board at a time, but the Card Tests can only run on the active card or repeat continuously. You can start a tone or loop on one board, go to another board, and then start a tone or loop. If you start a Card Test, you will not be allowed to select another card until the test is terminated.

Chapter 5

If Problems Occur

Service Parts

You can purchase these items separately, as shown below:

Item	IBM Part Number
Non-Micro Channel Audio Adapter board only	34F2786
Micro Channel Audio Adapter board only	34F2787
Software diskette	34F2793
Manual only	34F2795

Troubleshooting Hints

This chapter provides general troubleshooting hints to solve problems that might occur with the Audio Adapter. Service personnel should follow the instructions in Appendix A: Diagnostic Procedures. If your problem persists after following the suggestions in this chapter, contact your service representative.

Problem: You suspect that your Audio Adapter is not working correctly.

- Run the Audio Adapter diagnostics according to the instructions in Chapter 4.

Problem: When you try to use the Audio Adapter Diagnostics, you obtain error messages.

- Your Audio Adapter may not be fully seated in its slot. Turn off the power to your computer, unplug it and remove your cover according to the instructions in your IBM *Quick Reference* or *Guide to Operations*. Remove the Audio Adapter and then replace it carefully. Hold the Audio Adapter by the corners, making sure that it is straight, and press firmly until it clicks into place. See Chapter 1 (Micro Channel) or Chapter 2 (Non-Micro Channel) for complete instructions on installing the board. After you reseat the board, try running the diagnostics again.

- Make sure that you do not have a conflict between the Audio Adapter's configuration settings and another device in your system. If you have a PS/2 Micro Channel computer, use the IBM Set Configuration program on the Reference diskette to

check the input/output address and other configuration settings. If you have a non-Micro Channel system, make sure that the settings for your Audio Adapter do not conflict with another device in your system, as instructed in Chapter 2

- If you still obtain error messages after completing the steps above, contact your service representative.

Problem: You run the Tone utility program from the Audio Adapter Diagnostics and hear no sound from your speaker.

- First you should check to make sure that your Audio Adapter has been installed properly with all cables attached securely in the correct positions. See Chapter 3 for instructions.

- If you are using the PS/2 Micro Channel computer's internal speaker, make sure that it is turned on from the *Toggle* menu. Remember that the Micro Channel computer's internal speaker can only play from the Right channel.

  Check the values for the Oscillator Frequency and Volume. They must be set to audible levels. The frequency should be between 500 and 5000 Hz. The volume should be between +7.8 dbv (maximum volume) and -20.0 dbv (very quiet tone). If you are listening through earphones, rather than from a speaker, remember to choose lower values to avoid blaring noise in your ears.

- Check the audio equipment connected to the Audio Adapter to assure that it is in good working order and that it is properly connected to the Audio Adapter. See Chapter 3 for instructions.

Problem: You run the Loop utility program from the Audio Adapter Diagnostics and hear no sound.

- First you should check to make sure that your Audio Adapter and cables have been installed properly, as instructed in Chapter 3.

- If you are using the PS/2 Micro Channel computer's internal speaker, make sure that it is turned on from the *Toggle* menu. Remember that the internal speaker uses the right channel only. You can verify that the internal speaker is working correctly by pressing any key that is not used by the diagnostic software, such as "b".

- Verify that your input and output devices are connected to match your selection on the *Digital Loop* menu (left or right in and out).

- Verify correct operation of your external audio equipment. The Loop requires an audio input and some means of monitoring the output. You can check the cabling and setup of your external equipment by connecting your external audio inputs and outputs together, looping them directly without using the Audio Adapter. When the external equipment is connected this way, you should hear sound from your output device. After verifying your external equipment, reconnect your external audio equipment to the Audio Adapter and try the

Loop utility again. If problems persist, contact your service representative.

Problem: You receive a Timeout error when you run the Card Test from the Audio Adapter Diagnostics.

- This message indicates that interrupts are not working properly. You should check your setup to assure that you are using a valid interrupt. Follow the instructions in Chapter 1 (Micro Channel Audio Adapter) or Chapter 2 (non-Micro Channel Audio Adapter) to set the interrupt level. If your setup is correct and you still receive Timeout Errors, you should contact your service representative.

Problem: Your microphone does not seem to be working with the Audio Adapter.

- Run the Audio Adapter diagnostics to verify that the board is working.

- Make sure that your microphone is turned on and securely plugged into the proper connector on the board.

- Make sure that your output device is turned on and securely plugged into the proper connector on the board.

- Select *Mike in to L and R out* from the Loop Menu of the diagnostics. Speak into your microphone and listen to your speaker or headset. If you hear your voice through the speaker or headset, the problem may originate with your applications

software. Consult your application manual to insure proper installation.

- Make sure that your microphone conforms to the recommended specifications detailed in the Introduction under *Input and Output Devices*.

Problem: You hear a buzz or obtain poor audio quality when you use your microphone.

- Assure that your microphone is securely plugged into the connector on the Audio Adapter.

- Make sure that your microphone conforms to the recommended specifications detailed in the Introduction under *Input and Output Devices*. The cable on your microphone might be too long (six foot maximum) or one of the other requirements might not be fulfilled.

- If you have a metal microphone, use a microphone stand to eliminate *ground loop* and antenna effects. Both of these will cause a buzzing sound.

Problem: You hear no sound from your headphone or speakers.

- Verify that your headphone or speaker is in good working order.

- Run the basic diagnostics to verify that the board is working. If the tests pass, select the *Tone* utility from the advanced diagnostics. Assure that your headphone or speaker cable is securely plugged into the connector on the Audio Adapter. If you

do not hear a tone, contact your service representative.

Problem: Your line output does not seem to be functioning.

- Your line output cables may be loose or they may be malfunctioning. Check your cables to assure that they are securely plugged in.

- Verify that your external audio equipment is installed and set up correctly, according to the instructions in your owner's manual. Verify that switches are set correctly. Set mono/stereo switches to stereo and set balance control to the center.

- Select *Oscillator Start* from the Tone utility of the Audio Adapter diagnostics. If you hear nothing, replace your audio equipment with a headset. If you hear a tone on the left and right headset, the problem is with your cabling or setup. If you hear nothing from the headset, contact your service representative.

Problem: You hear a buzz from your line input.

- Your line input cables may be loose or they may be malfunctioning. Check your cables to assure that they are securely plugged in.

- Your cables may be too long.

- Your external audio equipment may not be grounded.

- If the problem persists, contact your service representative.

Problem: Your audio quality is not satisfactory.

- Your input level may be too high.
- Your cables may be malfunctioning or they may be too long.
- Your output amplifier may be causing distortion.
- If the problem persists, contact your service representative.

Section 2

Technical Reference

Chapter 6

Technical Information

Specifications

Input Analog Performance

Input Sampling Rate	44.1 KHz (stereo) 88.2 KHz (mono)
Input Channel Bandwidth	12 Hz to 20 KHz, 3 dB cutoff (typical)
Dynamic Range	16-bit resolution
Signal-to-noise ratio	80 dB (typical)
Line level input impedance	30K ohms (typical)
Line level voltage	7 volts peak-peak maximum
Microphone input impedance	20 K Ohms (typical)
Microphone gain	+33/+45 dB
S/(N+D)	78 db (typical)

Output Analog Performance

Output Sampling Rate	88.2 KHz Both Channels
Output Channel Bandwidth	12 Hz to 24 KHz, 3 dB cutoff (typical)
Dynamic Range	16-bit resolution
Signal-to-noise ratio	80 dB (typical)
Line level drive capacity	10 K ohms minimum
Line level voltage	7.0 volts peak-peak maximum
Speaker/Headphone drive	≥ 4 ohms
Speaker power	110 mw typical (8 ohm load)
S/(N+D)	78 db (typical)

Connectors

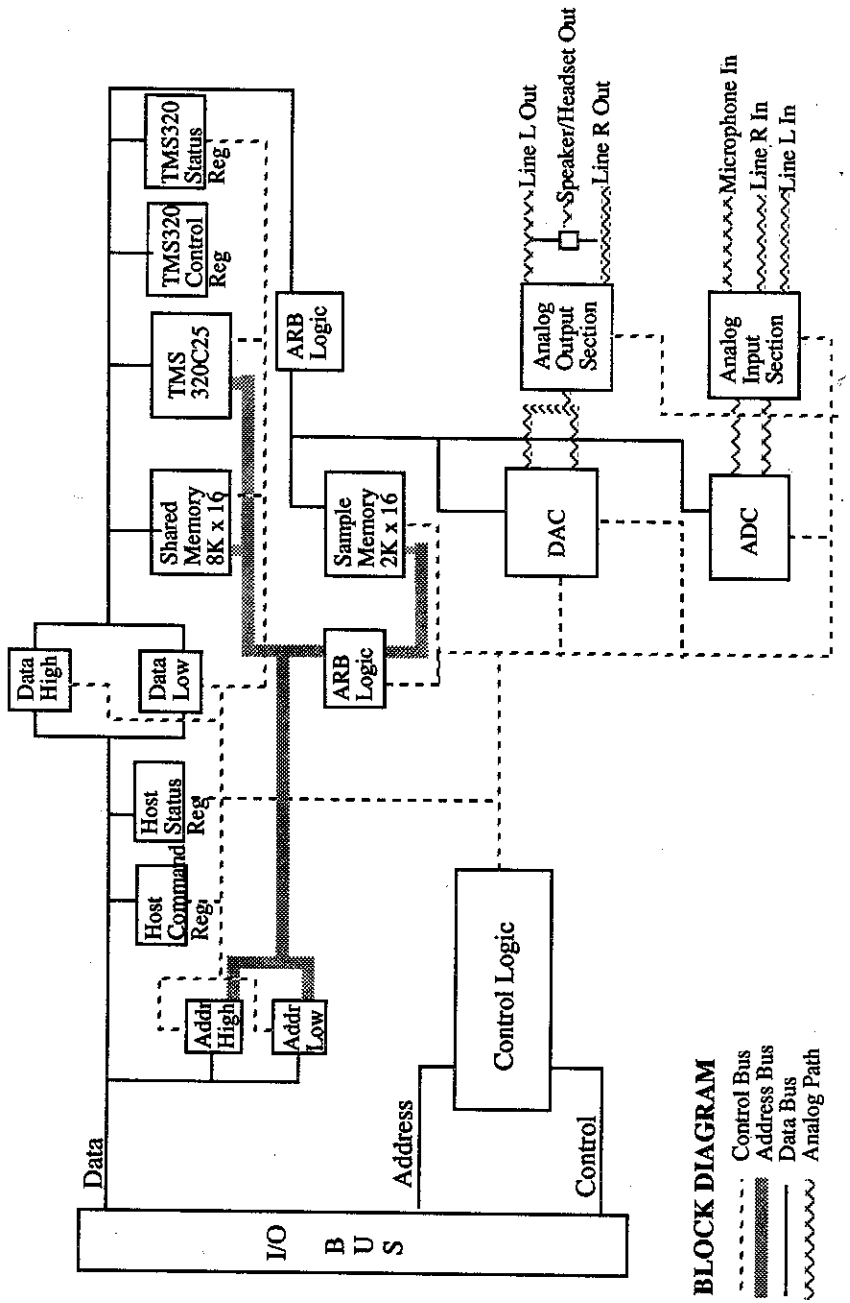
Microphone input (1)	Mini-phone jack (3.5mm)
Speaker (1)	Mini-stereo phone jack (3.5mm)
Line (2)	Mini-stereo phone jacks (3.5mm)

Test Condition 1 KHz, +7 dBV

Power Consumption

+5 V	1.5 A
+12 V	55 mA
-12 V	55 mA

Note: The 55 milliamps from the -12 volts exceeds the 40 milliamps per slot available in the Micro Channel computer. This will not cause a problem in most systems, since most boards use very little -12 volt power.



Overview

The essential elements of the Audio Adapter are shown in the block diagram on the previous page. The host to Audio Adapter interface is the Micro Channel or PC I/O bus. Using the I/O bus, the host can access the Command Register, the Status Register, Address High Byte latched counter, Address Low Byte latched counter, Data High Byte bidirectional latch, and the Data Low Byte bidirectional latch.

The Host Command and Host Status registers are used by the host to issue commands and monitor the status of the Audio Adapter. The Address and Data latches are used by the host to access the Shared Memory: 8K x 16 fast static RAM on the Audio Adapter.

The heart of the Audio Adapter is the TMS320C25 Digital Signal Processor. The purpose of this sophisticated processor is to run the audio card, support a software protocol interface to the host, and perform audio algorithms.

The Shared Memory is the means by which the host and the TMS320C25 communicate. This memory is "shared" in the sense that both the host and the TMS320C25 can access it. A memory arbiter, part of the Control Logic, prevents the host and TMS320C25 from accessing the memory at the same time. The TMS320C25 also has its own Command and Status registers for issuing commands and monitoring the status of other parts of the Audio Adapter.

The Audio Adapter contains another block of RAM referred to as the Sample Memory. The Sample Memory is 2K x 16 static RAM which the TMS320C25 uses for outgoing samples to be played and incoming samples of digitized audio.

The DAC and ADC are interfaces between the digital world of the Audio Adapter and the analog world of the universe. The DAC is the Digital to Analog Converter which gets digital samples from the Sample Memory, converts these samples to analog signals, and gives these signals to the Analog Output Section. The Analog Output Section conditions and sends the

signals to the output connectors. The DAC is multiplexed to give continuous operation to both outputs.

The ADC is the Analog to Digital Converter, the counterpart of the DAC. The ADC gets analog signals from the Analog Input Section (which received these signals from the input connectors), converts these analog signals to digital samples, and stores them in the Sample Memory.

The Control Logic is a block of logic which (among other tasks) issues interrupts to the host after a TMS320C25 interrupt request, controls the input selection switch, and issues read, write, and enable strobes to the various latches and the Sample and Shared Memory.

For an overview of what the Audio Adapter is doing, let's consider how an analog signal is sampled and stored. The host informs the TMS320C25 that the Audio Adapter should digitize an analog signal. The TMS320C25 uses its Command Register to enable the ADC. The ADC digitizes the incoming signal and places the samples in the Sample Memory. The TMS320C25 gets the samples from the Sample Memory and transfers them to the Shared Memory. The TMS320C25 then informs the host that digital samples are ready for the host to read. The host gets these samples over the Micro Channel or PC bus and stores them.

Of course, many other events are occurring behind the scenes. The Control Logic prevents the host and TMS320C25 from accessing the Shared Memory at the same time; prevents the TMS320C25, the ADC and the DAC from accessing the Sample Memory at the same time; controls the sampling of the analog signal; and performs other functions. These important details are discussed later in this section.

The scenerio above is a continuous operation. While the host is reading digital samples from the Shared Memory, the ADC is putting new data in the Sample Memory, and the TMS320C25 is transferring data from the Sample Memory to the Shared Memory.

Playing back the digitized audio works generally the same way. The host informs the TMS320C25 that the Audio Adapter should play back digitized data. The host gets the samples from its own memory and transfers them to the Shared Memory over the Micro Channel or PC bus. The TMS320C25 takes these samples and places them in Sample Memory. The TMS320C25 then activates the DAC which converts the digitized samples into audio signals. The audio play circuitry conditions the audio signals and places them on the output connectors. This is also a continuous operation. Sound can be played continuously without interruption.

During continuous record and playback, while the DAC and ADC are both operating, the TMS320C25 transfers samples back and forth between Sample and Shared Memory, and the host transfers samples back and forth over the Micro Channel or PC bus. This means that the Audio Adapter has the ability to play and record different sounds simultaneously!

You might wonder why the host doesn't access the Sample Memory directly, rather than have the TMS320C25 transfer the digitized data. It works that way because in most cases the TMS320C25 is not simply transferring the data from one memory block to the other. The data is usually processed by the TMS320C25 to some degree. For example, the data could be digitally filtered, compressed on sampling, decompressed on playback, or altered by any number of complicated algorithms.

The sampling and playback operations of the Audio Adapter are all controlled by software. The software in the host runs the Audio Adapter, and the software on the Audio Adapter runs the TMS320C25.

POS Registers

This section describes the POS Registers on the Micro Channel Audio. If you have the non-Micro Channel Audio Adapter, you can skip this discussion and continue with the section titled "Host I/O Map" on page 6-11.

Peripherals added to IBM Micro Channel computers contain a set of Programmable Option Select (POS) registers which contain default configuration information. Access to these registers is through four reserved locations in the I/O space of the PS/2 Micro Channel computer. The Audio Adapter interface uses one 8-bit I/O location at 0102 hexadecimal to control configurable features. This location is referred to as POS2. The two 8-bit I/O locations at 0100h and 0101h contain the interface identification number. You can consult the IBM Technical Reference Manual for information on the POS registers.

POS Registers Used by the Audio Adapter/A

POS	Bits								
Address	7	6	5	4	3	2	1	0	
100h	0	1	1	0	1	1	0	0	6C
101h	0	1	1	0	1	1	1	0	6E
102h	x	x	IR2	IR1	IR0	AS1	AS0	BDEN	POS2

User programs should not write to the POS registers. When you need to make changes to the POS registers for future operation, use the IBM Reference Diskette.

Peripherals for IBM Micro Channel computers have identification numbers that are used to identify which slot they occupy in the PS/2. When selected by the Slot Select Register, the Audio Adapter will respond to an I/O read from locations 0100h and 0101h hexadecimal with the identification bytes of 6Ch and 6Eh respectively.

A software switch that turns on the operation of the Micro Channel Audio Adapter is located at POS2, bit 0. When bit 0 equals zero, the interface is disabled and will not respond to programming of the I/O registers. When bit 0 equals one, the interface is enabled.

Software access to the features on the Micro Channel Audio Adapter is through a set of registers. These registers are used for writing information to the board or for reading information from the board. Eight contiguous byte locations are used in the PS/2 I/O space to provide access to the registers. The base or starting address for the first I/O location is determined by bits 1 and 2 of POS2 during the PS/2 power-on intitialization. The other locations are offset from that address. Follow the table below to decode the base address.

POS2 Bits		Base Address
2	1	
0	0	FDC0h
0	1	FDC8h
1	0	FDD0h
1	1	FDD8h

The Micro Channel Audio Adapter has the capability of generating an interrupt request on any of eight interrupt levels. The interrupt level is determined by bits 3, 4 and 5 of POS2 during the PS/2 power-on initialization. The following table describes the POS2 bit value and interrupt level

POS2 Bits			IRQ
5	4	3	Level
0	0	0	3
0	0	1	4
0	1	0	5
0	1	1	6
1	0	0	2
1	0	1	10
1	1	0	11
1	1	1	12

Host I/O Map

The Audio Adapter occupies eight consecutive locations in the I/O space of the host. With the Micro Channel Audio Adapter, the starting I/O address is selected from the IBM Set Configuration program, described in Chapter 1. With the non-Micro Channel Audio Adapter the starting I/O address is selected by switch module SW1, described in Chapter 2. The Host I/O map is as follows:

Base Address	Read	Write
0	Data - Low Byte	Data - Low Byte
1	Data - High Byte	Data - High Byte
2	Reserved	Reserved
3	Reserved	Reserved
4	Reserved	Address - Low Byte
5	Reserved	Address - High Byte
6	Host - Status Register	Host - Command Register
7	ACPA - ID	Reserved

The I/O READ Locations

Data - Low Byte: Low byte of 16-bit word read from Shared Memory.

Data - High Byte: High byte of 16-bit word read from Shared Memory.

Host - Status Register: Bit mapped register indicating Audio Adapter status.

Host - Status Register Bit Definitions

D7	D6	D5	D4	D3	D2	D1	D0
X	I3	I2	I1	X	X	HST REQ	TMS INT

Bit 0 TMS INT: TMS Interrupt indicates if the TMS320C25 has acknowledged interrupt from host.
1 - Interrupt serviced by TMS320C25 - power up/reset condition
0 - Interrupt pending from host to TMS320C25

Bit 1 HST REQ : Host Request indicates if a request from the TMS320C25 has been serviced by the host.
1 - Request pending from TMS320C25 to host
0 - Request serviced by host - power up/reset condition

Bit 4, 5, 6: I1, I2, I3 (For the non-Micro Channel Audio Adapter only) Bits 4, 5, and 6 indicate the interrupt level for which the non-Micro Channel Audio Adapter is configured. The PC program uses these bits to determine the interrupt level.

I3	I2	I1	Interrupt Level
0	0	0	7
0	0	1	6
0	1	0	5
0	1	1	4
1	0	0	3
1	0	1	2
1	1	0	Interrupts disabled
1	1	1	Interrupts disabled

ACPA - ID: For non-Micro Channel Audio Adapter only; contains byte "6C"

PC software can read this byte to determine the base address of the Audio Adapter. If the base + 7 equals "6C", an Audio Adapter could be present. If the base + 7 does not equal "6C", an Audio Adapter is NOT present.

Note: It is necessary that a "6C" be read at offset 7 for an Audio Adapter to be present. However, it is not sufficient. The probability that another device will provide the same information is low, but the application programmer should be aware that the possibility does exist.

The I/O WRITE Locations:

Data - Low Byte: Low byte of 16-bit word written to Shared Memory.

Date - High Byte: High byte of 16-bit word written to Shared Memory.

Address - Low Byte: Low byte of 16-bit address in Shared Memory address space.

Address - High Byte: High byte of 16-bit address in Shared Memory address space.

Host - Command Register: Bit mapped register used by host to handle interrupts and reset the Audio Adapter. Host Command Register bits are either latched or strobed bits. A latched bit remains set according to the last signal it received, while a strobed bit performs an action once (like a pulse) and then returns to its previous state.

Host - Command Register Bit Definitions

D7	D6	D5	D4	D3	D2	D1	D0
X	X	X	SPKR EN	TMS INT	HINTENA	HREQACK	TMS RES

Bit 0 TMS RES: TMS Reset (latched bit)
Resets the TMS320C25 and the Audio Adapter
1 - TMS320C25 is in operating state
0 - TMS320C25 is in reset state - power up/reset condition

Bit 1 HREQACK: Host Request Acknowledge (strobed bit)
Used to indicate the host has/is servicing the request from the TMS320C25.
0 - Clears interrupt from the TMS320C25

Bit 2 HINTENA: Host Interrupt Enable (latched bit)
Allows host to gate requests from the TMS320C25 to the interrupt bus.
1 - TMS requests to the host cause a host interrupt
0 - TMS requests to the host do not cause a host interrupt - power up/reset condition

Bit 3 TMS INT: TMS Interrupt (strobed bit)
Used by the host to interrupt the TMS320C25
0 - Interrupts the TMS320C25

Bit 4 SPKR EN: Speaker Enable (latched bit)
Used by the host to enable or disable the Micro Channel PS/2 computer's internal speaker. This bit is not used with the non-Micro Channel Audio Adapter.
1 - Speaker enabled (on)
0 - Speaker disabled (off) - power up/reset condition

TMS320C25 I/O Map

The TMS320C25 Digital Signal Processor on the Audio Adapter uses two bit-mapped registers in its I/O space: the Local Status Register and the Local Command Register. These registers are used to control and monitor the sample and playback functions, as well as handshake with the host and TMS320C25 interrupts. Since the Status Register is read-only and the Command Register is write-only, no I/O address decoding is performed. This means that the Status Register is accessed by a TMS320C25 I/O read to any address, and the Command Register is accessed by a TMS320C25 I/O write to any address.

TMS320C25 - Status Register: Bit mapped register indicating Audio Adapter/A status.

TMS320C25 - Status Register Bit Definitions

D7	D6	D5	D4	D3	D2	D1	D0
X	X	X	X	HST REQ	ADC INT	DACL INT	DACR INT

Bit 0 DACR INT: DAC Right Interrupt indicates an interrupt from Digital to Analog Converter Right.
1 - Interrupt from DAC R to TMS320C25 pending
0 - No interrupt - power up/reset condition

Bit 1 DACL INT: DAC Left Interrupt indicates an interrupt from Digital to Analog Converter Left.
1 - Interrupt from DAC L to TMS320C25 pending
0 - No interrupt - power up/reset condition

Bit 2 ADC INT: ADC Interrupt indicates an interrupt from the Analog to Digital Converter
1 - Interrupt from ADC to TMS320C25 pending
0 - No interrupt - power up/reset condition

Bit 3 HST REQ: Host Request indicates if a request from the TMS320C25 has been serviced by the host
1 - Request pending from TMS320C25 to host
0 - Request serviced by host - power up/reset condition

TMS320C25 -Command Register: Bit mapped register indicating Audio Adapter/A status

TMS320C25 - Command Register Bit Definitions

D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
MIKE	AD	BLK	HST	TMS	SPB	INP	ADC	DACL	DACR
GAIN	CHAN	RST	REQ	IAK	IAK	SEL	EN	EN	EN

Bit 0 DACR EN: DAC Right enable (latched bit)
Allows the TMS320C25 to enable or disable the Digital to Analog Converter Right.
1 - DACR enabled
0 - DACR disabled - power up/reset condition

Bit 1 DACL EN: DAC Left enable (latched bit)
Allows the TMS320C25 to enable or disable the Digital to Analog Converter Left.
1 - DACL enabled
0 - DACL disabled - power up/reset condition

Bit 2 ADC EN: ADC enable (latched bit)
Allows the TMS320C25 to enable or disable the Analog to Digital Converter.
1 - ADC enabled
0 - ADC disabled - power up/reset condition

Bit 3 INP SEL: Input select (latched bit)
Allows the TMS320C25 to select the Right input source as microphone or line.
1 - Line selected - power up/reset condition
0 - Mike selected - power up/reset condition

Bit 4 SPB IAK: Sample Playback Interrupt Acknowledge (strobed bit)
Used by the TMS320C25 to acknowledge a sample playback interrupt request. This clears the interrupt pending latch.
0 - Acknowledges the sample playback interrupt

Bit 5 TMS IAK: TMS Interrupt Acknowledge (strobed bit)
Used by the TMS320C25 to acknowledge an interrupt from the host - i.e. it clears the interrupt pending latch.
0 - Acknowledges the TMS320C25 interrupt from the host

Bit 6 HST REQ: Host Request (strobed bit)
Used by the TMS320C25 to request service from the host.
0 - Requests service from the Host

Note: If HINTENA (bit D2 of the Host Command Register) is set to a logic 1, then the HST REQ by the TMS320C25 will cause a host interrupt. If the HINTENA bit is a 0, no interrupt will occur. Independent of the HINTENA bit, the host can poll its HST REQ bit (bit 1 of the Host Status Register) to determine if a request is pending from the TMS320C25.

Bit 7 BLK RST: Block Reset (strobed bit)
Forces sample memory to the first location of Block 0. This bit is normally at a "1" state, since synchronization to the first location of block 0 is automatic at the beginning of a sample playback cycle.
0 - Resets Sample Memory to the first location of block 0.

Bit 8 AD CHAN: A/D Channel (latched bit)
Used by the TMS320C25 to select the right channel continuously sampled at 88.2 KHz or alternating between the left and right channels for effective sample rate of 44.1 KHz per channel.
1 - Right and left channel sampled at 44.1 KHz each
0 - Right channel sampled at 88.2 KHz - power up/reset condition

Bit 9 MIKE GAIN: Microphone Gain (latched bit)
Used by the TMS320C25 to select one of two available gains for the microphone input.
1 - + 33 db
0 - + 45 db - power up/reset condition

TMS320C25 Memory Map

The TMS320C25 Digital Signal Processor on the Audio Adapter has two types of memory spaces; program memory and data memory. The TMS320C25 can address 64K of program memory and 64K of data memory. The chart *TMS320C25 Memory Space* on the next page shows how the program and data spaces are arranged on the Audio Adapter.

The Audio Adapter contains two blocks of fast static RAM referred to as Shared Memory and Sample Memory. The Shared and Sample Memory are mapped into repetitive segments of the program and data spaces of the TMS320C25, because the Audio Adapter does not perform a full decode of the TMS320C25 address space.

The TMS320C25 Memory Space chart reveals that data/program virtual addresses 1FFFh, 3FFFh, 9FFFh, and BFFFh all access the same physical location in the Shared Memory. Data virtual addresses 4000h, 5800h, D000h and F800h (for example) all access the same physical location in the Sample Memory. Program virtual addresses 4000h, 5800h, D000h and F800h all access the same physical location in the Shared Memory. Note that the Shared Memory is addressed as both program memory and data memory, while the Sample Memory is strictly data memory.

Specifically, whenever the TMS320C25 accesses a data or program location which is addressed with A14 = 0 , then the physical Shared Memory is accessed. Whenever the TMS320C25 accesses a data or program location which is addressed with A14 = 1 , then accesses to the data space will be to the Sample Memory, and access to the program space will be to the Shared Memory.

TMS320C25 Memory Space

Bit A14	Address	Data Space	Program Space
1	F800-FFFF	Sample - P	Note 1 - H
1	F000-F7FF	Sample - O	Shared - H
1	E800-E8FF	Sample - N	Shared - H
1	E0FF-E7FF	Sample - M	Shared - H
1	D800-DFFF	Sample - L	Shared - G
1	D000-D7FF	Sample - K	Shared - G
1	C800-CFFF	Sample - J	Shared - G
1	C000-C7FF	Sample - I	Shared - G
0	A000-BFFF	Shared - D	Shared - F
0	8000-9FFF	Shared - C	Shared - E
1	7800-7FFF	Sample - H	Shared - D
1	7000-77FF	Sample - G	Shared - D
1	6800-6FFF	Sample - F	Shared - D
1	6000-67FF	Sample - E	Shared - D
1	5800-5FFF	Sample - D	Shared - C
1	5000-57FF	Sample - C	Shared - C
1	4800-4FFF	Sample - B	Shared - C
1	4000-47FF	Sample - A	Shared - C
0	2000-3FFF	Shared - B	Shared - B
0	0400-1FFF	Shared - A	Shared - A
0	0020-03FF	Note 1 - A	Shared - A
0	0000-001F	Note 1 - A	Note 2 - A

Note: Shared Memory Size = 8K x 16 bits
Sample Memory Size = 2K x 16 bits

Data space contains:
4 repetitive blocks of Shared Memory (A through D).
16 repetitive blocks of Sample Memory (A through P)

Program space contains:
8 repetitive blocks of Shared Memory (A through H).

Sample Memory Organization

Address	Memory Space
4700-47FF	ADC BLK 1
4600-46FF	ADC BLK 0
4500-45FF	SCR BLK 1
4400-44FF	SCR BLK 0
4300-43FF	DAC R BLK 1
4200-42FF	DAC R BLK 0
4100-41FF	DAC L BLK 1
4000-40FF	DAC L BLK 0

TMS320C25 Address Decoding

A15	A14	A13	A12	A11	A10	A9	A8	A7	A6	A5	A4	A3	A2	A1	A0	
X	0	X	←												→	Shared Memory Addresses
X	1	X	X	X	←										→	Sample Memory Addresses

Note 1: This consists of 544 16 bit words of on-chip data RAM. 288 words are always configured as data memory. The remaining 256 words can be configured as either program or data memory. If configured as program memory, it will be located from program address FF00h to FFFFh. Locations 0-5 of data memory are for the TMS320C25 on-chip memory mapped registers.

Note 2: Program locations 0-31 consist of interrupt vectors and reserved locations.

For additional information on the TMS320C25, consult the Texas Instruments programming manual, "Second Generation TMS320 User's Guide."

Shared Memory

The Audio Adapter contains 8K x 16 fast static RAM which can be accessed by the host and the TMS320C25. It is called Shared Memory. The TMS320C25 program, which resides in the Shared Memory space, is stored by the host and downloaded to Shared Memory for execution by the TMS320C25.

The host also downloads to the Shared Memory any samples required by the Audio Adapter for playback at the outputs. Input signal samples are placed by the TMS320C25 into the Shared Memory for the host to read and store (in its own memory). Arbitration between the host and the TMS320C25 for Shared Memory is an automatic function of the Audio Adapter's Control Logic. As a result, access to the Shared Memory is controlled, so that the host and the TMS320C25 do not simultaneously attempt to read or write a location.

The Shared Memory can be accessed by the host for downloading TMS320C25 code, downloading samples to be played, uploading samples, or communicating with the TMS320C25. The host interface to the Shared Memory is I/O mapped, using two I/O locations. One location serves as the memory address pointer into the Shared Memory. It is capable of autoincrementing. The other I/O location provides the read or write data.

For the host to access a word location in the Audio Adapter's Shared Memory, the address of the location must first be sent to the Audio Adapter. You do this by using I/O write locations Address High Byte and Address Low Byte. The host writes the lower 8 bits of a 16-bit Audio Adapter memory address at I/O location Address Low Byte, and the upper 8 bits of a 16-bit Audio Adapter memory address at I/O location Address High Byte.

The 16-bit address is latched on the Audio Adapter and is automatically incremented with accesses to I/O read or write locations Data High Byte. As a result, to read or write a block of memory on the Audio Adapter, the host only has to write the 16-bit address of the beginning of the memory block to I/O write

locations Address Low Byte and Address High Byte, and then consecutively read or write data via the I/O read data and write data locations until the memory access is completed. The order should be Low Byte first, then High Byte to ensure orderly memory access, if you are using Byte-wide accesses. This is necessary, because address incrementing occurs on the High Byte access.

The Shared Memory is addressed as both program memory and data memory. It is the responsibility of the programmer to be sure that the data space and the program space within the Shared Memory do not collide. The TMS320C25 uses locations 0000h to 001Fh for interrupt vectors and reserved program locations, and the TMS320C25 starts executing code at location 0000h on reset. Program space must start at location 0000h of the Shared Memory space. The TMS320C25 has 544 words of internal data memory from address 0000h to 03FFh. Shared Memory in the data space starts at location 0400h. Situating the program space in low Shared Memory and the data space in high Shared Memory will allow you to access the internal 544 word data space and preserve the TMS320C25 requirements for the reserved program locations.

Refer to the chart *TMS320C25 Memory Space* on page 6-20 for additional information.

Sample Memory

The Sample Memory is 2K x 16 static RAM which the TMS320C25 uses for incoming samples to be played and outgoing samples of digitized audio. Unlike the Shared Memory, the Sample Memory is not accessible by the host.

The Sample Memory is accessed in the TMS320C25 data space only, as indicated in the *TMS320C25 Memory Space* chart. Sample memory is organized according to the destination or origin of the samples. The Audio Adapter splits the 2K Sample Memory into eight 256 word blocks: two blocks for DACR, two blocks for DACL, two blocks for the ADC and two scratch-memory blocks. An example of the way sample memory is organized appears in the *Sample Memory Organization* chart on page 6-20. This method of organization applies no matter which memory address is used in the TMS320C25 data space.

The Sample Memory is divided into blocks to allow the TMS320C25, the DAC and the ADC to access Sample Memory without colliding. For example, when the DACR is to play back samples, the TMS320C25 loads the samples from the Shared Memory into Sample Memory DACR Block 0. Then DACR is enabled. While the DAC is accessing DACR Block 0, the TMS320C25 fills DACR Block 1 with more samples. When the DAC finishes playing back the samples in DACR Block 0, it continues to play by using the samples in DACR Block 1 and the TMS320C25 fills DACR Block 0 with more samples. This ping-pong of memory access continues while the DAC is continuously playing samples.

The same procedure is followed with the ADC, except that the ADC writes the samples into one of the ADC blocks while the TMS320C25 reads the samples from the other ADC block, transferring them to Shared Memory where the host reads the samples and stores them in its memory. Again the ping-pong of memory continues while the ADC continuously digitizes samples.

Read the discussion in the next section on *TMS320C25 Interrupt Handling* for tips on approaches to block handling to avoid problems with synchronization.

The TMS320C25 program must keep track of which blocks to service. It does this with the help of interrupts.

TMS320C25 Interrupt Handling

The TMS320C25 uses interrupts for two basic functions; for communication to the host and for flow control on sample/playback cycles. Host communication uses interrupt INT1 of the TMS320C25. Sample/playback functions use INT0.

A TMS interrupt, an interrupt from the host to the TMS320C25, will force the TMS320C25 to jump to the interrupt service routine for the INT1 interrupt.

The TMS320C25 should strobe "0" the TMS IAK (TMS Interrupt Acknowledge) bit of the TMS320C25 Command Register to acknowledge reception of the interrupt from the host. This will set the TMS INT bit of the host Status Register.

A sample/playback interrupt, i.e. an interrupt from ADC, DACR or DACL to the TMS320C25 will force the TMS320C25 to jump to the interrupt service routine for the INT0 interrupt. The TMS320C25 can then read from the TMS320C25 Status Register bits ADC INT, DACR INT and DACL INT to ascertain the source of the interrupt. The sample/playback interrupt is needed so the TMS320C25 knows which block to service. The first interrupt after enabling DACR, DACL, or ADC the TMS320C25 must service Block 1 of the interrupt source.

Consider the case of playback, for example. The TMS320C25 fills DAC Block 0. The DAC is then enabled. Upon reception of a sample/playback interrupt, the TMS320C25 interrogates its Status Register to determine the source of the interrupt. When the first corresponding DAC interrupt occurs, the TMS320C25 should start filling Block 1, since the DAC is currently reading from Block 0. This approach must be followed to ensure orderly startup.

The same situation occurs in record mode. The TMS320C25 enables the ADC. When it receives the first ADC interrupt, the TMS320C25 starts to read data from Block 1 while the ADC is loading Block 0. However, since the ADC has just been

enabled when it starts filling Block 0, Block 1 contains garbage at this time. You can either ignore the first interrupt for the ADC, or you can store one block of garbage and deal with it later. Either approach is acceptable. The important thing is to be sure that you do not get out of sychronization in accesses to the Blocks. The TMS320C25 should never access Block 0 on the first interrupt after enabling the DACs or ADC.

The Bio pin of the TMS320C25 can be interrogated to determine which block the TMS320C25 should be accessing. Bio essentially indicates the block the DAC and ADC are accessing, i.e. Bio = 0 means the TMS320C25 can access Block 1. Bio = 1 means the TMS320C25 can access Block 0. Synchronization is easy by using the BIOZ instruction of the TMS320C25.

Remember that when you enable DACR, or DACL or ADC (or any combination of them), the TMS320C25 will immediately get an interrupt from the enabled devices. This indicates that the device is servicing block 0 and the TMS320C25 has permission to access Block 1. From then on, just ping-pong the accesses from one block to the other upon reception of Sample/playback interrupts.

The TMS320C25 acknowledges the interrupt by strobing "0" the SPB IAK (Sample/playback Interrupt Acknowledge) bit of the TMS320C25 Command Register. The acknowledgement of the interrupt will clear the interrupt from the INT0 pin.

The TMS320C25 can interrupt the host by strobing "0" the HST REQ bit of the TMS320C25 Command Register. The request will only result in a host interrupt, if the host has set HINTENA (bit D2 of the Host Command Register) to a 1.

Host Request Handling

Communication between the host and the TMS320C25 on the Audio Adapter can be accomplished using interrupts. Host I/O locations Host Status Register and Host Command Register are bit mapped registers used by the host to handle interrupts.

The host interrupt (interrupt from the TMS320C25 to the host) is selected from the IBM Set Configuration with the Micro Channel Audio Adapter or from the SW1 switch setting with the non-Micro Channel Audio Adapter. The non-Micro Channel Audio Adapter can use any interrupt from IRQ2 through IRQ7. IRQ7 is a shared interrupt request, because IRQ7 uses I/O location 2F7h as the GlobalRearm locator (explained in the section on "Interrupt Sharing" in the IBM Technical Reference manual for non-Micro Channel computers). The Micro Channel Audio Adapter can use IRQ2 through IRQ6 or IRQ10 through IRQ12.

To be interrupted by the TMS320C25, the host must set to 1 the HINTENA (Host Interrupt Enable) bit of the Host Command Register. This bit allows a host request from the TMS320C25 to cause a host interrupt. The TMS320C25 requests service from the host by strobing "0" the HST REQ (Host Request) bit of the TMS320C25 Command register.

Upon interrupt from the TMS320C25, the host can read the HST REQ (Host Request) bit of the Host Status Register to verify that it is a valid interrupt from the Audio Adapter. This bit is set by the TMS320C25 when requesting service from the host. The TMS320C25 can also monitor its HST INT bit of the TMS320C25 Status Register to determine if the host has serviced the request. The host clears an interrupt from the TMS320C25 by strobing "0" the HREQACK (Host Request Acknowledge) bit of the Host Command Register. Clearing of an interrupt removes the interrupt request from the interrupt bus and clears the HST REQ bits of the TMS320C25 Status Register and the Host Status Register. Clearing of a pending interrupt usually occurs in the corresponding interrupt service routine.

An interrupt by the host to the TMS320C25, referred to as a TMS interrupt, is initiated by the host strobing "0" the TMSINT (TMS Interrupt) bit of the Host Command Register. The host can monitor the TMSINT (TMS Interrupt) bit of the Host Status Register to see if the TMS320C25 acknowledges the interrupt.

Communication between the host and the TMS320C25 on the Audio Adapter can also be accomplished using polling instead of interrupts. The scenerio is similar to the previous discussion of host interrupts, except that the host resets the HINTENA (Host Interrupt Enable) bit of the Host Command Register to "0". Now any requests from the TMS320C25 will not cause an interrupt, but will set the HST INT bits of the TMS320C25 Status Register and Host Status Register. The host can poll the HST INT bit of its Status Register to determine when the TMS320C25 requests service, and can clear the request by strobing "0" the HREQACK (Host Request Acknowledge) bit of the Host Command Register.

Programming the Audio Adapter

Two basic types of programs exist for the Audio Adapter, host programs and TMS320C25 programs. Host programs are responsible for telling the Audio Adapter what actions to take, such as sampling an input, playing back a file to a desired output or testing the board. TMS320C25 programs control getting the job done. This includes performing the actual sampling at the desired input, performing the actual playback to the desired output, or performing the actual test. In essence the host gives the commands and the TMS320C25 carries out those commands.

The host and the TMS320C25 can communicate via any number of protocols using interrupts and/or Shared Memory. One method of Host/TMS320C25 communication using interrupts and Shared Memory is used by the diagnostic software. In this method the host gives instructions to the TMS320C25 by writing a code to a Shared Memory location and interrupting the

TMS320C25. The TMS320C25 reads the code from Shared Memory when it receives the interrupt.

The TMS320C25 gives responses to the host by writing a code to Shared Memory and interrupting the host. The host reads the code from Shared Memory when it receives the interrupt. The host program and the TMS320C25 program agree on the meaning of the codes and where they will be located in the Shared Memory space. For example, the diagnostic software for the TMS320C25 is loaded in Shared Memory from 0000h to 0800h. The host uses 0900h to write the test codes and 0901h to read the results from the TMS320C25. A test code of 04 is used for the Output Tones utility.

The interface between the host and the Audio Adapter should use the handshake as outlined above. Polling the Shared memory will reduce the available performance of the TMS320C25 due to the method used to arbitrate the Shared Memory.

The combination of a host program and a TMS320C25 program produces an Audio Record & Playback Adapter program.

Important Note: The HM bit (Bit 6 of Status Register St1) of the TMS320C25 Internal Register should always be reset (HM=0). The TMS320C25 has two instructions that affect his bit, RHM and SHM. The careful programmer will use the RHM instruction in the initialization portion of the TMS320C25 code and will NEVER issue an SHM. Failure to adhere to this procedure could lead to unpredictable results. Refer to the Texas Instruments programming manual, "Second-Generation TMS320 User's Guide," for additional information.

Appendix A

Diagnostic Procedures

If you are experiencing any problems using the Audio Adapter, follow these diagnostic procedures to determine the cause of the failure. Always start with step A001 for any problem.

Step A001

Before you begin:

- Boot your system with DOS 3.3 or higher or the DOS box in OS/2.
- Unplug all devices connected to the Audio Adapter.
- Place the Audio Adapter diskette in drive A: or change to the directory where the diagnostics program has been copied.
- Type the following command from the drive or directory where you have the Audio Adapter diagnostics software and then press Enter:

  >ACPADIAG

Did the Audio Adapter pass the diagnostics?

If YES
Go to step A002

If NO
Go to step A040

Step A002

- Insert the Audio Adapter diskette in drive A: or change to the directory where the diagnostics program has been copied. Type the following command from the drive or directory where you have the diagnostics software and then press Enter:

  >ACPADIAG/A

If you are experiencing problems with some of the external devices or connections, use the following listing to diagnose your problem or set up your system.

MICROPHONE DEAD
Go to step A100

MICROPHONE SETUP
Go to step A100

BUZZ &/OR POOR AUDIO QUALITY ON MICROPHONE INPUT
Go to step A150

HEADPHONE/SPEAKER OUTPUT DEAD
Go to step A200

BUZZ &/OR POOR AUDIO QUALITY ON THE HEADSET/ SPEAKER SETUP
Go to step A200

HEADSET/SPEAKER SETUP
Go to step A200

LINE OUTPUT/INPUT DEAD (1 OR 2 CHANNELS)
Go to step A300

LINE INPUT/OUTPUT SETUP
Go to step A300

BUZZ &/or POOR AUDIO QUALITY ON LINE INPUT/OUTPUT
Go to step A350

MICRO CHANNEL SPEAKER DEAD
Go to step A400

Step A040

Error messages were received while running the Audio Adapter diagnostics

Is the Audio Adapter a Micro Channel architecture board?

If YES
Go to step A041
If NO
Go to step A042

Step A041

Installation problems with the Micro Channel Audio Adapter

Possible problems:

° Your Audio Adapter may not be fully seated in its slot
Turn off the power to your computer, unplug it and remove your cover according to the instructions in your IBM Quick Reference manual. Remove the Audio Adapter and then replace it carefully. Hold the Audio Adapter by the corners, making sure that it is straight, and press firmly until it clicks into place. See Chapter 1 for complete instructions on installing the board.

° Configuration conflict
Use the backup Reference disk to verify no conflicts.

After performing the above procedures, repeat step A001. If the failure persists, replace the Audio Adapter.

Step A042

Installation problems with Audio Adapter non-Micro Channel board

Possible problems:

° Your Audio Adapter may not be fully seated in its slot
Turn off the power to your computer. Unplug it and remove your cover according to the instructions in your Guide to Operations. Remove the Audio Adapter and then replace it carefully. Hold the Audio Adapter by the corners, making sure that it is straight, and press firmly until it clicks into place. See Chapter 2 for complete instructions on installing the board.

- Configuration conflict
  Verify that no other device that is installed in the system is using the same I/O address and interrupt level as the Audio Adapter. If a conflict exists, move the interrupt jumper or switch settings to another valid location. (See Chapter 2.)

- Improper I/O address selection
  Verify that the I/O address switches are set to a valid value. (See Chapter 2.)

After performing the above procedures, perform step A001. If the failure persists, replace the Audio Adapter.

Step A100

Microphone Dead
When the microphone is used for input, no sound is recorded or heard.

Microphone Setup
Use this test to verify the proper operation of the microphone path of the Audio Adapter with your microphone.

Equipment Required:
- Speaker or headset or external audio equipment with speakers
- Microphone

Before you begin:

- Plug the microphone into the microphone input. Be sure the connector is firmly seated.
- Plug the speaker/headphone into the speaker/headphone output. Be sure the connector is firmly seated. (Your external audio equipment may also be used to perform this test. Connect external audio equipment to the line output).
- Cursor to "Loop" on the action bar. Press ↵.
- Cursor to "Mike in to L and R out". Press ↵.
- Verify that "Mike Gain" is set for LOW. If not, cursor to Toggle. Then cursor to Mike Gain and press ↵.

Perform step A101 to verify proper operation of the microphone input.

Step A101

Talk into the microphone and listen to the Speaker/headset.
Can you hear yourself talking out of the speaker/headset?

If YES
Go to step A102
If NO
Go to step A105

Step A102

- Set Microphone Gain to high in the Card Select window. Move the cursor to "Toggle" on the action bar and press ↵. Next move the cursor to "Mike Gain" and press ↵ to select *Microphone Gain: high.*

Talk into the microphone and listen to the speaker/headset.
Can you hear yourself talking out of the speaker/headset at a higher volume level than the previous step?

If YES
Go to step A103
If NO
The microphone gain adjustment may be malfunctioning. Replace the Audio Adapter.

Step A103

The hardware microphone path is operational. If you are experiencing problems using the microphone with other software, please check the procedures that came with the software package you are running on the Audio Adapter.
Return to step A001 to continue testing external devices.

Step A105

Possible problems:

- Broken microphone &/or cable.
- Microphone not turned on
- Microphone of incorrect type (see discussion of input devices on page vii of the Introduction.)

Correct the above problems if any. Repeat step A100.
If the problem persists, replace the Audio Adapter.

Step A150

BUZZ &/OR POOR AUDIO QUALITY ON MICROPHONE INPUT
When using the microphone there is a buzz, hum or other noise that is present in the data.

Equipment Required:
- Speaker or headset or external audio equipment with speakers
- Microphone

Before you begin:

- Plug the microphone into the microphone input. Be sure the connector is firmly seated.
- Plug the speaker/headphone into the speaker/headphone output. Be sure the connector is firmly seated. (Your external audio equipment may also be used to perform this test. Connect external audio equipment to the line output.)
- Cursor to "Loop" on the action bar. Press ↵.
- Cursor to "Mike in to L and R out". Press ↵.
- Hold the microphone as you normally do when making recordings with the Audio Adapter.

Perform the following test to verify proper operation of microphone input.
Pick up the microphone.

Would you describe the noise you hear as a hum or a buzz?

If YES
Go to step A151
If NO
Go to step A154

Step A151

Lay the microphone down on a nonconducting (non-metallic) surface.

Did the loudness of the buzz or hum decrease?

If YES
Go to step A152
If NO
Go to step A153

Step A152

This noise is being caused by a ground loop and/or antenna effects.
Use a microphone stand with this microphone or use the low gain setting to minimize the noise.
Return to step A001 to continue testing external devices.

Step A153

The buzz/hum could be caused by the following items:

- Microphone cable greater than 6 feet in length.
- Unshielded cable
- Broken Microphone
- Bent Connectors

Correct the above items and repeat step A150.
If the problem persists, replace the Audio Adapter.

Step A154

Other noises such as cracking and popping can be caused by:

- Broken Cables
- Broken Connectors

- Bent Connectors
- Broken Microphone

Verify that the above items are in good condition on the microphone and its cable. Correct any problems found. Return to step A001 to continue testing external devices. If the problem persists, replace the Audio Adapter.

Step A200

Headset/speaker dead
When using headset/speaker output there is no sound.
Headset/speaker setup
Use this test to verify the proper operation of the headset/speaker output.

Equipment Required:
Stereo speaker or stereo headset that are known to be good

Before you begin:

- Plug the speaker/headphone into the speaker/headphone output. Be sure the connector is firmly seated.
- Cursor to "Tone" on the Action Bar. Press ↵.
- Cursor to "Change Oscillator Values". Press ↵.

Left Channel Check

- Press Tab to the frequency of the right channel.
- Type **0.**
- Verify that the frequency of the left channel is 440, and the volume of the left and right channels is -20. If you need to change values, press Tab to move to the desired item and type in the new value.
- Press ↵ to accept all changes.
- Cursor to "Tone" on the Action Bar. Press ↵.
- Cursor to " Oscillator Start." Press ↵

Do you hear the tone coming out of the left speaker/headset only?
You can adjust the volume by pressing F7 (softer) or F8 (louder).

If YES
Go to step A202
If NO
Go to step A203

Step A202

Your left channel is set up and operational.
Go to A210 for right channel check.

Step A203

Is there a tone on both sides of the headset?

If YES
Make sure the speaker/headset has a stereo mini connector.
Make sure the speaker/headset is in working order. Correct any problem and return to step A001 to continue testing external devices.
If the above conditions do not need correcting, the speaker/headset output may be broken. Replace the Audio Adapter.
If NO
Go to step A204.

Step A204

Do you hear a tone coming out of the right speaker/headset only.

If YES
Verify the diagnostic setup described in step A200.
Check to be sure that you do not have your cables swapped.
After correcting any of the above problems, return to step A200.
If the error persists, replace the Audio Adapter.
If NO
At this point you hear nothing from any speaker.
Verify the diagnostic setup described in step A200.
Check or replace your cabling. Make sure you are using stereo cables and plugs. Then repeat step A200.
If the problem persists, replace the Audio Adapter.

Step A210

Right Channel Check

- Cursor to "Tone" on the pull down menu. Press ↵.
- Cursor to "Change Oscillator Values". Press ↵.
- Tab to the frequency of the right channel.
- Type 440.
- Tab to the frequency of the left channel.

- Type 0.
- Verify that the volume of the left and right channels is -20. If you need to change values, press Tab to move to the desired item and type in the new value.
- Press ↵ to accept all changes .
- Cursor to "Tone" on the pull down. Press ↵ .
- Cursor to "Oscillator Start ". Press ↵ .

Do you hear the tone coming out of the right speaker/headset only? (If you wish to adjust the volume, press F7 (softer) or F8 (louder).)

If YES
Go to step A212
If NO
Go to step A213

Step A212

Your right channel is setup and operational.
Return to step A001 to continue testing external devices.

Step A213

Is there a tone on both sides of the headset?

If YES
Make sure the speaker/headset has a stereo mini connector.
Make sure the speaker/headset is in working order. Correct any problem and return to step A001 to continue testing external devices.
If the above conditions do not need correcting, the speaker/headset output may be broken. Replace the Audio Adapter.
If NO
Go to step A214.

Step A214

Do you hear a tone coming out of the left speaker/headset only.

If YES
Verify the diagnostic setup described in step A200.
Check to be sure that you do not have your cables swapped.

After correcting any of the above problems, return to step A200.
If the error persists, replace the Audio Adapter.
If NO
At this point you hear nothing from any speaker.
Verify the diagnostic setup described in step A200.
Check or replace your cabling. Make sure you are using stereo cables and plugs. Then repeat step A200.
If the problem persists, replace the Audio Adapter.

Step A300

Line input/output dead
When using line input or output, one or both channels have no sound.

Line input/output setup
This routine will help you connect the Audio Adapter to external audio equipment and verify its proper operation.

Diagnostics have verified the functional operation of the line level input and output. This test will help you to set up external audio hardware for proper operation with Audio Adapter.

Equipment Required:
- External audio equipment with speakers that are known to be good
- Input device on line level

Verify line output path

Before you begin:

- Plug the external audio equipment into the line output. Be sure the connector is firmly seated.
- Verify that the line outputs of the Audio Adapter are connected to line inputs on the external audio hardware. (i.e. Preamplifier/Amplifier)
- Verify proper setup of all external audio hardware. (Consult the user/installation guide that came with your equipment.)
- Verify that power is connected and turned on to all audio hardware.
- Set mono/stereo switches to stereo on all external audio equipment.
- Set balance control switches to the center.
- Cursor to "Tone" on the Action Bar. Press ↵ .
- Cursor to "Change Oscillator Values". Press ↵ .

Left Channel check

- Press Tab to the frequency of the right channel.
- Type **0.**
- Verify that the frequency of the left channel is 440, and the volume of the left and right channels is -20. If you need to change values, press Tab to move to the desired item and type in the new value.
- Press ↵ to accept all changes.
- Cursor to "Tone" on the Action Bar. Press ↵.
- Cursor to " Oscillator Start." Press ↵

Do you hear the tone coming out of the left speaker of your audio system only? (If you wish to adjust the volume, press F7 (softer) or F8 (louder).

If YES
Go to step 302
If NO
Go to step A303

Step A302

Your left channel is setup and operational.
Go to A310 for right channel check.

Step A303

Is there a tone on both speakers of your audio system?

If YES
Set mono/stereo switches to stereo on all external audio equipment.
Set balance control switches to the center.
If the error continues try using a new set of cables or different audio equipment. If the error still continues, replace the Audio Adapter.
Return to step A001 to continue testing external devices.
If NO
Go to step A304.

Step A304

Do you hear a tone from the right speaker only of your audio system.

If YES
Verify the diagnostic setup described in step A300.
Check to be sure that you do not have your cables swapped.
After correcting any of the above problems, return to step A300.
If the error persists, replace the Audio Adapter.
If NO
At this point you hear nothing from any speaker.
Verify the diagnostic setup described in step A300.
Check the switch settings on your external audio equipment (i.e. volume and balance) to be sure they are set correctly.
Check or replace your cabling. Make sure you are using stereo cables and plugs. Then repeat step A300.
If the problem persists, replace the Audio Adapter.

Step A310

Right Channel Check

- Cursor to "Tone" on the pull down. Press ↵.
- Cursor to "Change Oscillator Values". Press ↵.
- Tab to the frequency of the right channel.
- Type 440.
- Tab to the frequency of the left channel.
- Type 0.
- Verify that the volume of the left and right channels is -20. If you need to change values, press Tab to move to the desired item and type in the new value.
- Press ↵ to accept the changes.
- Cursor to "Tone" on the pull down menu. Press ↵.
- Cursor to "Start Oscillator". Press ↵.

Do you hear the tone coming out of the right speaker of your audio system only?

If YES
Go to step 311
If NO
Go to step A313

Step A311

Your right channel is setup and operational.
Go to A320 to verify line input capability.

Step A313

Is there a tone on both speakers of your audio system?

If YES
Set mono/stereo switches to stereo on all external audio equipment.
Set balance control switches to the center.
If the error continues try using a new set of cables or different audio equipment. If the error persists, replace the Audio Adapter.
Return to step A001 to continue testing external devices.
If NO
Go to step A314

Step A314

Do you hear a tone from the left speaker only of your audio system.

If YES
Verify the diagnostic setup described in step A300.
Check to be sure that you do not have your cables swapped.
After correcting any of the above problems, return to step A300.
If the error persists, replace the Audio Adapter.
If NO
At this point you hear nothing from any speaker.
Verify the diagnostic setup described in step A300.
Check the switch settings on your external audio equipment (i.e. volume and balance) to be sure they are set correctly.
Check or replace your cabling. Make sure you are using stereo cables and plugs. Then repeat step A300.
If the problem persists, replace the Audio Adapter.

Step A320

Verify line input capabilities

- Plug the input source into the line level input. Be sure the connector is firmly seated.

- Plug the line level output into the receiving audio device. Be sure the connector is firmly seated.
- Cursor to "Loop" on the action bar. Press ↵.
- Cursor to "L in to L out, R in to R out". Press ↵.
- Play some audio through the path.
- Listen carefully to the quality of the audio being wrapped through the Audio Adapter.

Do you hear sound coming out of the speakers on audio system?

If YES
Go to step A321
If NO
Go to step A322

Step A321

The line input paths are working properly.
Return to step A001 to continue testing external devices.

Step A322

Use a cable to wrap input to output of your external audio equipment, i.e. substitute a cable for the Audio Adapter in the Loop path.

Do you hear sound coming out of the speakers on the external audio system?

If YES
Your external audio equipment and cables seem to be in good working order. Repeat step A320. If the problem persists, replace the Audio Adapter.
If NO
Verify proper setup of all external audio hardware. (Consult the user/installation guide that came with your equipment.)
Verify that power is connected and turned on to all audio hardware.
Swap the cables and connectors that were being used to connect the line input of Audio Adapter to the audio system
Repeat step A320 after correcting problems with the external audio equipment.

Step A350

BUZZ &/OR POOR AUDIO QUALITY ON LINE OUTPUT/INPUT

Equipment Required:

- External audio equipment (with speakers known to be good).
- A line level input source

Before you begin:

- Set up the your audio system to play the line level input source directly..
- Play some audio through the system and listen carefully to the quality.
- Plug the input source into the line level input. Be sure the connector is firmly seated.
- Plug the line level output into the receiving audio device. Be sure the connector is firmly seated.
- Cursor to "Loop" on the action bar. Press ↵.
- Cursor to "L in to L out, R in to R out". Press ↵.
- Listen carefully to the quality of the audio being wrapped through the Audio Adapter.

Does the sound playing through the card and playing directly sound equal?

If YES
The Audio Adapter is working properly. Please consult the user manual of the software that you are using on the Audio Adapter. Return to step A001 to continue testing external devices.
If NO
Go to step A351

Step A351

Swap the cables and connectors that were being used to connect the Audio Adapter to the audio system.

Does the sound playing through the card and playing directly sound equal?
If YES
There was a bad cable(s) in the group that was replaced. Return to step A001 to continue testing external devices.
If NO
The Audio Adapter line input/output may be broken. Replace the Audio Adapter.

Step A400

Micro Channel speaker dead
When using the Micro Channel speaker, there is no sound
Micro Channel speaker setup
Use this test to verify proper operation of the Micro Channel speaker.

Equipment Required: None

Before you begin:

- Cursor to "Tone" on the pull down menu. Press ↵.
- Cursor to "Change Oscillator Values". Press ↵.
- Tab to the frequency of the right channel.
- Type 440.
- Tab to the frequency of the left channel.
- Type 0.
- Verify that the volume of the left and right channels is -20. If you need to change values, press Tab to move to the desired item and type in the new value.
- Press ↵ to accept all changes .
- Cursor to "Tone" on the pull down. Press ↵.
- Cursor to "Oscillator Start ". Press ↵.

Do you hear the tone coming out of the Micro Channel speaker? (If you wish to adjust the volume, press F7 (softer) or F8 (louder).)

If YES
Go to step A401
If NO
Go to step A402

Step A401

Your Micro Channel speaker is set up and operational.
Return to step A001 to continue testing external devices.

Step A402

Does the letter "b" beep the speaker?

If YES

The Audio Adapter is not driving the Micro Channel Speaker. Repeat step A400. If the problem persists, replace the Audio Adapter.

If NO

The Micro Channel speaker does not appear to be working. Run the diagnostics from your IBM Reference diskette and correct the problem.

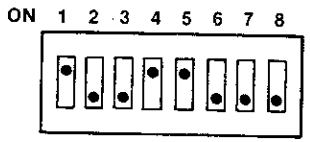
Appendix B

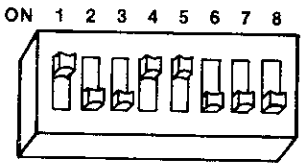
Switch Modules

Many types of switch modules may be found on system boards or adapter boards. Three different types are shown below in the drawings labeled Slide, Rocker or Toggle Switch Module.

In these examples switches one, four and five are ON, while the rest are OFF.

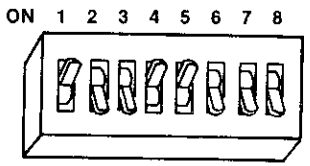
The top drawing with the black dots inside the rectangles shows the way switch settings are depicted throughout this manual.





Slide Switch Module

Rocker Switch Module



Toggle Switch Module

You set the switch modules by depressing one side of the designated rocker switch or by pushing a slide or toggle switch towards one side of the switch module with a ballpoint pen or small screwdriver. Do not use a pencil.

A switch set OFF is depressed or moved towards the bottom of the switch module, and a switch set ON is depressed or moved towards the top of the switch module.

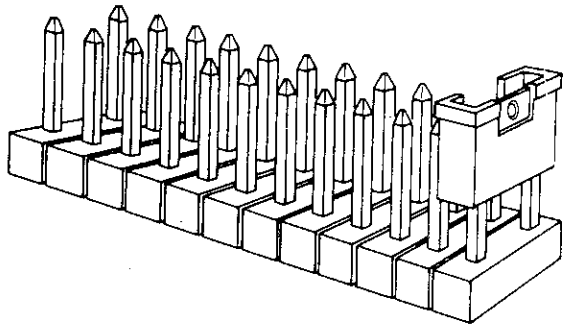
Note: When a switch is OPEN, it is turned OFF. When it is CLOSED, it is ON. Labels vary from one switch to another. Some have only the words ON, while others have only the word OPEN.

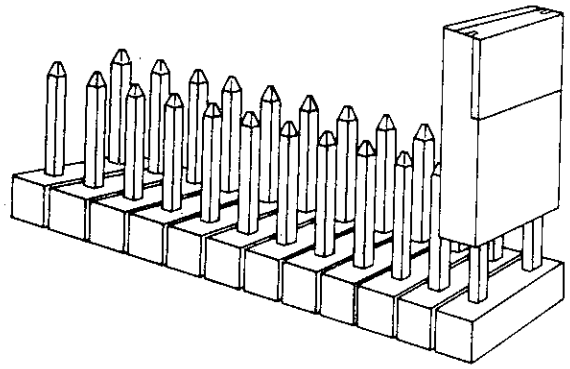
Labels such as SW1, SW2, etc. or S1, S2, etc. are generally used on system or adapter boards to identify switch modules.

Setting Jumpers

There are various types of jumper blocks. The types pictured here are often found on Tecmar boards. A jumper block consists of a plastic block with wire pins protruding from its top surface. Positions are connected by placing a plastic cap over two adjacent pins. The two pins represent one position on the jumper block.

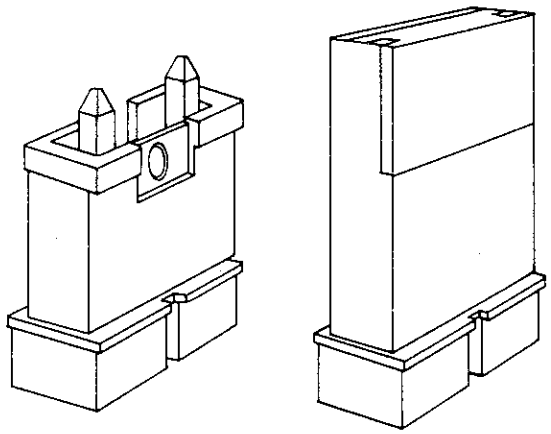
The jumper blocks shown below have two different styles of plastic caps.



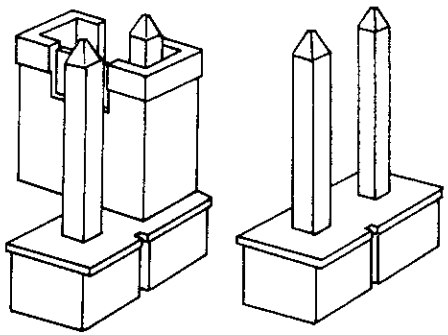


To disconnect a position, remove the plastic cap by hand or with a pair of tweezers or needle-nose pliers.

When the plastic cap is in place, a connection has been made and that position is jumpered.



Jumpered



Not Jumpered

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